

April 12, 1966

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ROTARY PISTON ENGINES

3,245,612

Filed May 17, 1965.

10 Sheets-Sheet 5

Fig. 10

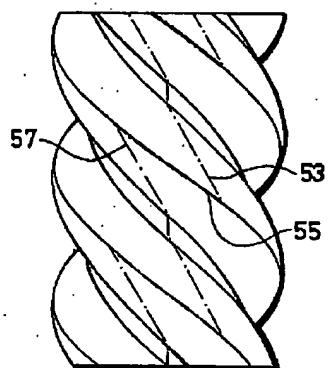


Fig. 11

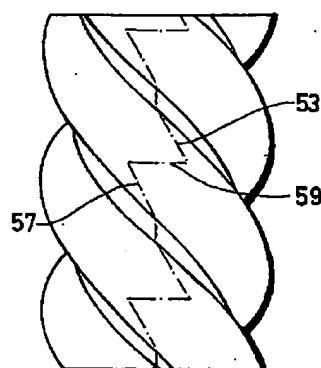


Fig. 12

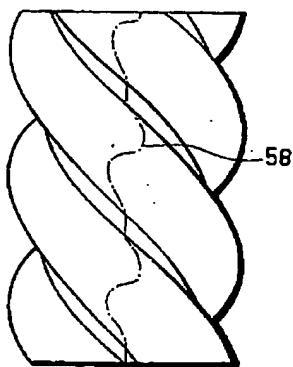
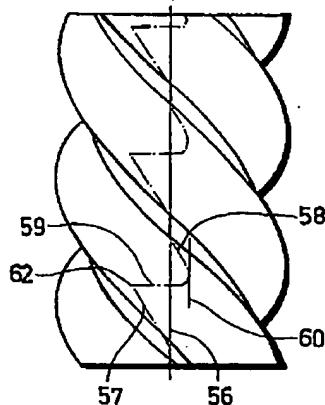


Fig. 13



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continuously along both the mating flanks, whereby the relative sliding speed between the flanks is less than at the generated root portion of the generally circular profile. In this way the wear owing to friction at direct contact will be decreased and it will simultaneously be distributed all over the flanks instead of comprising only the edge of the female rotor groove 50 and the inner portion of the male rotor land 46 that is generated by the edge. Furthermore the effect is obtained by the moving point of cooperation that the pocket between the flanks of the groove and the land is continuously decreased as its trailing end, the point of cooperation 54, moves in the direction opposite to that of the rotation of the rotors as shown in FIGS. 4-7. A symmetrical profile produced by travelling generation as shown in FIG. 2 which can be illustrated by a mirror image of FIGS. 4-7 brings down the volume of said pocket to zero by the continuous travelling of its inner end from the bottom to the edge of the groove so that the pocket disappears in a gentle way. The corresponding pocket of the circular profile on the other hand extends from its forming to its disappearing over the whole length of both the flanks of the groove and at its disappearance the pocket is momentarily closed all over the length of the flanks, i.e. the outer end of the pocket brings the pocket to zero volume in the same degree as the inner end does, whereby an accelerated speed of the discharge from the pocket is obtained.

Owing to this gentle disappearance of the pocket there will be no abrupt increase of the pressure in the pocket with acceleration following therefrom of the working fluid discharged from the pocket. This increase of pressure and acceleration which has been produced by all earlier known rotor profiles has been the source of a non-uniform speed of the working fluid and thus of the vibrations and the noise derived therefrom. The sound derived from this source of noise is thus eliminated by the type of profile according to the invention.

Furthermore the sealing between flanks with profiles produced by travelling generation is obtained between two curved surfaces having a common tangent at the point of cooperation and having about the same radii of curvature so that this sealing in a plane transverse to the axes of the rotors cannot be considered as a point sealing but a line sealing as the opening between the cooperating flanks extending over a considerable angle of the flank is so small that a sealing effect is obtained. The total three-dimensional sealing will for this reason not be a sealing along a line but a sealing along a band which is much more effective than the sealing over the edge of the groove of earlier known profiles which sealing cannot form such an opening with circumferential extension on more than one side of the theoretical sealing point. The sealing over the theoretical sealing line will for this reason be considerably more effective for the profile produced by travelling generation than for the generally circular one.

It must be observed that all comparisons with earlier known profiles have been made with the circular profile which owing to wear, elimination of pockets, as well as sealing is clearly superior to the other earlier used profile, i.e. the profile generated by a point.

It is, however, not only the effectiveness of the sealing over the sealing line that is of importance but also the length of this sealing line. In FIGS. 10 and 11 the sealing lines have for this reason been projected on the male rotors for the flank profiles used up to now, i.e. the profile generated by a point and the generally circular profile, respectively. These figures are moreover already shown in Nilsson Patent No. 2,622,787 granted Dec. 23, 1952 as an illustration of the great improvement from sealing view that the change from the profile generated by a point to the circular one means. FIG. 10 shows a sealing line of a land generated by a point. The leading flank of the male rotor land sealingly meshes with the edge of

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the female rotor from the root to the crest of the land along a line 53, the crest of the land sealingly meshes with the flanks of the groove from one edge to the other along a line 55, and the other edge of the groove sealingly meshes with the trailing flank of the land along a line 57. FIG. 11 shows a sealing line of the circular profile. The line 55 in FIG. 10 along the crest of the land is replaced by a line 59 perpendicular to the axes of the rotor so that the length of the lines 53 and 57 simultaneously are decreased to about half their length.

In FIG. 12 the projection on a male rotor of the sealing line 58 between the rotors with symmetrical profiles produced by travelling generation has been shown in a corresponding way. Owing to the fact that the sealing point on the female rotor groove as shown above is not fixed to the edge of the groove but immediately starts travelling inwardly towards the bottom of the groove the sealing line 58 forms a smaller angle with the axes of the rotor than the lines 53 and 57 do, as shown in FIGS. 10 and 11. As the sealing line produced by travelling generation is continuous as also shown above, it will have no points with break of the continuity which in form of acute angles of the sealing lines are characteristics of the earlier known profiles. The sealing line 58 will thus as shown in FIG. 12 follow a continuously curved line the tangents of which parallel with the axis of the rotor will lie considerably closer to said axis than the sharp angles of the earlier known sealing lines. The length of the sealing line is for this reason considerably shorter than the length of the earlier known profiles. FIG. 13 shows in the same way the sealing line 58, 59, 57 of an asymmetric profile according to FIG. 3. FIG. 13 is especially adapted for comparison of the projections on the male rotor of the sealing lines of a rotor profile produced by travelling generation and of a generally circular profile. As shown in FIG. 13 the distance from the axis 56 of the rotor to the tangent 60 parallel with this axis of the sealing line 58 of the profile produced by travelling generation is less than 50% of the distance from the axis 56 to the point of intersection 62 between the parts 59, 57 of the sealing line of the circular profile. The length of the line 58 from the root to the crest of the land will in this way be about 60% of the length of the corresponding part of the sum of the length of the lines 57 and 59. It is not impossible to further decrease the length of the line 58. The total length of the sealing line the projection of which is shown by the line 58 decreases simultaneously to 65-70% of the length of the corresponding sealing line of the circular profile. However, this sealing line will be shortened still more with a shape of the profile which as said above will shorten the length of the line 58 in relation to the embodiment shown.

As said above an improved sealing between the rotors is obtained owing to a shortened sealing line as well as to a broader sealing area. The leakage between the rotors will in this way decrease considerably which is essential for engines of the type as said leakage is a leakage from a chevron shaped chamber to groove portions communicating with the low pressure port while the leakage between two adjacent chevron shaped chambers is of less importance owing to the relatively small difference of pressure between the two adjacent chevron shaped chambers. The total leakage between the rotors will as seen from the information given above decrease to about 55% of the corresponding leakage in a similar engine provided with rotors of generally circular profile and as already said this leakage can be further decreased by further change of the profile. The increase of the blow holes between adjacent chevron shaped chambers that will be the result if the trailing flank of the male rotor land and the mating flank of the female rotor groove are produced by travelling generation will thus be compensated by the more effective sealing between the rotors.

Owing to the fact that the crest connecting the flanks of each male rotor land 46 rolls without any sliding mo-

